

Clarification of *Acacia multipinnata*, *A. paniculata*, *A. scandens* and *A. tenuifolia*

David S. Seigler¹ and John E. Ebinger²

¹Department of Plant Biology, 505 S. Goodwin Ave., University of Illinois, Urbana, Illinois 61801
seigler@life.illinois.edu (author for correspondence)

²Emeritus Professor of Botany, Eastern Illinois University, Charleston, Illinois 61920, U.S.A.

ABSTRACT

Acacia paniculata and *A. tenuifolia* are morphologically distinct species that are difficult to distinguish; both are validly published, legitimate names. Type materials of *A. paniculata*, *A. scandens*, and *A. multipinnata* represent the same species. The oldest validly published, legitimate name for this latter group of species is *A. paniculata* Willd. (1806). Many authors have used the names *A. paniculata* and *A. tenuifolia* interchangeably and ambiguously. Although it is not the oldest name, in order to maintain nomenclatural stability and in anticipation of a proposal to conserve the name against *A. paniculata*, we have elected to use the name *A. multipinnata*. Published on-line www.phytologia.org *Phytologia* 97(3): 179-186 (July 1, 2015). ISSN 030319430.

KEY WORDS: Fabaceae, Mimosoideae, *Acacia multipinnata*, *Acacia paniculata*, *Acacia scandens*, *Acacia tenuifolia*, *Senegalia multipinnata*, *Senegalia paniculata*, *Senegalia scandens*, *Senegalia tenuifolia*.

A body of evidence including both morphological and molecular data have demonstrated that the formerly broadly circumscribed, pantropical genus *Acacia* Mill. (Leguminosae: Mimosoideae) is polyphyletic and presently is considered to be comprised of at least five genera: *Acacia*, *Acaciella*, *Mariosousa*, *Senegalia*, and *Vachellia*. Largely because of these factors, *Acacia* Mill. has been re-typified (McNeill et al. 2005, 2007) with an Australian species, *A. penninervis* Sieber ex DC. After two votes to accept this change by International Botanical Congresses (McNeill and Turland. 2011) this change is increasingly being adopted (Maslin, 2015).

Members of *Senegalia* are shrubs, trees, or lianas, unarmed or armed with prickles, but without stipular spines. The prickles usually are scattered, but less commonly are grouped in twos or threes, usually at or near nodes (Vassal 1972). The leaves are bipinnate and the petiole and primary rachis have sessile or stipitate glands of variable structure and position. Flowers possess a more-or-less tubular nectary below the usually stipitate ovary. Inflorescences are globose heads or spikes, often grouped into complex terminal pseudo-inflorescences (synflorescences). Pods are dehiscent, separating into two valves at maturity, or less commonly indehiscent or separating into indehiscent one-seeded articles. The seeds are uniseriate. *Senegalia* consists of approximately 100 taxa in the Americas (Ebinger and Seigler, unpublished data), as well as 69 in Africa, 43 in Asia, and two in Australia (Maslin et al. 2003, 2013 and World Wide Wattle, <http://www.worldwidewattle.com>). Eight species occur in two or more areas.

Among species of *Senegalia*, the status of four names (*Senegalia multipinnata* (Ducke) Seigler & Ebinger, *S. paniculata* (Willd.) Killip ex Record, *S. scandens* (Willd.) Seigler & Ebinger and *S. tenuifolia* (L.) Britton & Rose) has been poorly understood. Although the original purpose of this study was to examine type materials and literature related to type materials for *Acacia paniculata* and *A. tenuifolia*, to determine if differences exist between the two species and to establish what should be the correct name

for these entities, as the study progressed it became clear that two other names, *A. multipinnata* and *A. scandens* had to be considered.

Senegalia multipinnata (Ducke) Seigler & Ebinger in Seigler, Ebinger & J. T. Miller, *Phytologia* 88: 60. 2006. TYPE: Brazil. Pará. “[L]ecta in regione Ariramba fluminis Trombetas,” 10 Dec. 1910, *A. Ducke 11411* (lectotype, designated by Grimes [1992: 267], MG; isolectotypes, NY [1526], US).
Acacia paniculata Willd., *Sp. Pl.* 4: 1074. 1806 non J. F. Macbride (1919)
Mimosa paniculata Poir., *Encycl., Suppl.* 1(1): 74. 1810. nom. illeg. non Wendland (1798).
Acacia scandens Willd., *Enum. Pl.* 1057. 1809. nom. illeg. non Willdenow (1806)
Manganaroa paniculata (Willd.) Speg., *Bol. Acad. Nat. Ci. (Córdoba)* 26: 239. (pl. 241, 243). 1921
Acacia multipinnata Ducke, *Arch. Jard. Bot. Río de Janeiro* 4: 31. 1925
Senegalia cordobana Britton & Killip, *Ann. New York Acad. Sci.* 35: 143. 1936
Senegalia paniculata (Willd.) Killip ex Record, *Trop. Woods* 63: 6. 1940
Senegalia scandens Seigler & Ebinger in Seigler, Ebinger & J. T. Miller, *Phytologia* 88: 72. 2006

Senegalia tenuifolia (L.) Britton & Rose, *N. Amer. Fl.* 23: 118. 1928. TYPE: “Habitat in America calidiori” (lectotype, designated by Seigler et al. [2006: 74], t. 17 from Plumier [1755]). Note: According to Grimes (1992), t. 17 from Plumier (1755) was not published, but was seen by Linnaeus. This plate is located in the Codex Boerhavianus in the library of the Rijksuniversiteit Groningen.

Basionym: *Mimosa tenuifolia* L., *Syst. Veg.* 771. 1774

Acacia tenuifolia (L.) Willd., *Sp. Pl.* 4: 1091. 1806

Acacia julibrissin Sieb. ex Mart., “*Herb. Fl. Bras.*” *Flora* 20(2). Beiblätter 109. 1837. nom. illeg. non Willdenow (1806)

Acacia claussenii Benth., *London J. Bot.* 1: 518. 1842

Acacia martinicensis K. Presl, *Abh. Königl. Böhm. Ges. Wiss. Series 5.* 3: 495. 1845

Acacia microcephala A. Rich. in Sagra, *Hist. Phys. Cuba, Bot. Pl. Vasc.* 4: 469. 1845. nom. illeg. non Macfadyen (1837)

Acacia tenuifolia (L.) Willd. var. *veraensis* Kitanov, *Ann. Univ. Sofia Fac. Biol.* 64(2): 60. 1972

The name *A. paniculata* Willd. (1806) is based on type material at B. There are two specimens with Cat. No. 19157, both Hoffmannsegg collections (Grimes 1992). Grimes lectotypified *A. paniculata* based on the flowering specimen; the fruiting specimen is a member of the genus *Anadenanthera*. Grimes (1992) also located type materials for *A. tenuifolia*, which was later lectotypified (Seigler et al. 2006).

In 1806, Willdenow retained *Acacia tenuifolia* (L.) Willd. (based on *Mimosa tenuifolia* L.) and described *A. paniculata* as a new species. Subsequently many authors have confounded the concept of *A. paniculata* with non-synonymous taxa. As a part of our continuing study of this difficult group of species, we examined type material for *A. paniculata* and compared morphological characters to those of *A. tenuifolia* based on Grimes (1992) who obtained data for the type materials of that species. In contrast to the type of *A. tenuifolia*, the type specimen of *A. paniculata* lacks anther glands, the midribs of leaflets are more-or-less central, and leaves of the type specimen possess 30-40 pairs of pinnae. At the same time, we examined the type of *Senegalia scandens* (Willd.) Seigler & Ebinger (Seigler et al. 2006) at B and, in our judgement, this specimen is identical in defining characteristics to that of *A. paniculata*. In contrast, specimens of *A. tenuifolia* typically have anther glands, fewer than 20 (but occasionally up to 28) pairs of pinnae and the leaflet midribs are marginal. The description in Linnaeus (1753) indicates that the species has “partialibus viginti-jugatis: propriis multijugatis.”

Plants congruent with the types of *Acacia paniculata* and *A. tenuifolia* occur from Mexico to southern South America. Those of *A. tenuifolia*, but not *A. paniculata*, are found in the Caribbean area (Ebinger and Seigler, unpublished data). In all probability, authors before 1806 (for instance, Houttuyn [1779] and Lamarck [1783]) attributed specimens of these species to *Mimosa tenuifolia* L. After 1806, taxonomists varied in their interpretation of these two species. Based on admittedly limited material, Bentham (1842) considered *A. paniculata* to be similar to a specimen from St. Lucia that was almost certainly *A. tenuifolia*. By the time of his 1875 monograph, Bentham considered *A. tenuifolia* (L.) Willd., *M. tenuifolia* L., *M. paniculata* Poir. and *M. paniculata* West in Vahl (1807) to be synonyms of *A. paniculata* Willd. and applied the “Kew Rule,” choosing the name *A. paniculata* (Grimes 1992). In the following year, Bentham (1876) included a description of *A. paniculata* with “costa submarginali” and “pinnis 10-20 jugis,” corresponding to *A. tenuifolia*, along with plate 101 that has anthers that lack glands and leaflets with more-or-less central midribs. These characters correspond to those of *A. paniculata*, although the number of pinna pairs corresponds to *A. tenuifolia*. Nonetheless, probably due to the influence of Bentham, subsequent authors frequently considered *A. paniculata* to be conspecific with *A. tenuifolia*. However, Britton and Rose (1928) transferred *M. tenuifolia* to *Senegalia* to form *Senegalia tenuifolia* (L.) Britton and Rose without mentioning *A. paniculata*.

Additional confusion occurred because of a Caribbean species *Mimosa paniculata* (West 1793), a nomen nudum from the Danish West Indies. This was later published as a new name, *M. paniculata* West ex Vahl (1807) that proved to be an illegitimate name (non Wendland [1798]). Afterward, *M. paniculata* West ex Vahl served as the basis for the new name *Acacia westiana* DC. (1825) and later as a new combination *Senegalia westiana* (DC.) Britton and Rose (1928). Vahl (1807) observed that *M. paniculata* West ex Vahl is different from *M. tenuifolia* L., although de Candolle (1825) conversely considered that *A. westiana* might be *M. tenuifolia*. To further complicate things, G. Don (1832) considered *M. paniculata* West ex Vahl to differ from *A. paniculata* Willd., but considered *A. paniculata* Willd. possibly to be the same as *M. tenuifolia* L. Subsequently, *S. westiana* has been recognized as a legitimate species by several authors including Britton and Rose (1928); Acevedo and Strong (2012); Bentham (1875) and Rico-Arce (2007). We consider this taxon to be a synonym of *A. riparia* Kunth (1823) (= *S. riparia* (Kunth) Britton and Rose in Britton and Killip (1936)).

Because plants that correspond to the type of *Acacia paniculata* do not occur in the Caribbean area, investigators who reported the presence of *A. paniculata* or *A. tenuifolia* in their study areas such as Acevedo and Strong (2012); Duss (1897); León and Alain (1951); Stehlé (1946) (as *Acacia tenuifolia*) and Stehlé et al. (1949) (as *A. paniculata*) actually examined *A. tenuifolia*. Howard (1988) considered *A. tenuifolia* and its synonyms to be the species common to the Lesser Antilles. Taxonomists who studied Caribbean plants worked with *A. tenuifolia* (L.) Willd. and not with *A. paniculata* Willd.

Information concerning salient features provided by the authors who studied *Acacia tenuifolia* and *A. paniculata* in Central and South America sometimes makes it possible to determine the identity of the materials used. Based on identification of herbarium materials and species ranges, some investigators probably had specimens of both *A. paniculata* and *A. tenuifolia* among their study materials and did not distinguish the two species. The characters cited by several investigators indicate that they worked with *A. tenuifolia*. For example, Ducke (1925) erroneously observed that “Le vrai *Acacia paniculata* a cependant les feuilles moins longues et les anthers (dans les boutons) couronnées d’une glande de couleur foncée” and cited Kuhlmann 3233 (RB) from Amazonas, Brazil, and material of the states of Minas Geraes and Ceará. His description indicates that the material to which he referred was *Senegalia tenuifolia*. Barroso (1964); Cárdenas and Martino (2001); da Silva (1990); Macbride (1943); Madsen (1990); McVaugh (1987); Woodson and Schery (1950) and Zamora (1991) all worked with *S. tenuifolia*. Rico-Arce (2001a, b and 2007) considered the materials she examined to be *A. tenuifolia*, but reported eglandular stamens. Although specimens of *A. tenuifolia* normally have anther glands, their absence is sometimes a function of age and the condition of flowers (Grimes 1992). Pulle (1940) correctly noted that *A. paniculata* lacked

anther glands and usually had 20-30 pairs of pinnae suggesting that he worked primarily with specimens of *A. paniculata*. Spegazzini (1921) proposed the genus *Manganaroa* largely based on the presence of anther glands. Based on his extensive descriptions, the materials examined were almost certainly *A. tenuifolia* (p. 239), which he designated as *Manganaroa paniculata* (Willd.) Spegazzini.

In contrast to the above examples, it is not always possible to determine whether the material examined was *Acacia paniculata* or *A. tenuifolia*, or perhaps other species. A number of investigators considered *A. paniculata* to be a synonym of *A. tenuifolia*: Barros (2011); Barros and Morim (2014); da Silva (1990); de Queiroz (2009); Forero and Romero (2009); Funk et al. (2007); Grimes (1992); Jørgensen and León (1999); Rico-Arce and Fonseca (2005); and Ribeiro (2012). Other workers have used the name *A. paniculata* without mentioning synonyms or *A. tenuifolia*: Barbosa et al. (2004); Calderón and Standley (1941); Chodat and Hassler (1904); Hassler (1898); Killeen et al. (1993); Lewis and Owen (1989); Rodal and Nascimento (2002); and Sprengel (1826).

As an additional part of our examination of relevant type material in the Willdenow collections at B, we discovered that the type of *A. scandens* Willd. (1809), an illegitimate name (non Willdenow [1806]), (B-W [bc] B-W 19194-010) [bc = barcode] was nearly identical to that of *A. paniculata* and represents the same species. As a further part of our study of *Senegalia*, we also examined isotypes of *A. multipinnata* and found that the specimens of all three species lacked anther glands, the leaflets had central venation, more than 20 pairs of pinnae (occasionally as few as 15 on leaves near the inflorescence) and, thus, possessed the major characters of *A. paniculata*. Upon microscopic examination, the types were nearly identical in pubescence and other observable features and represent material of a single species.

Acacia multipinnata Ducke is a widespread species of moist evergreen primary tropical forests and disturbed primary and secondary forests from sea level to 1,000 m in southern Mexico, Costa Rica and Panama south to Bolivia and western Brazil. It also occurs in Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, and Venezuela. In addition to the lectotype, a number of syntypes are known: *A. Ducke 10457*, *R. Spruce 494* (K [bc] K 000117769), and *J. G. Kuhlmann 17487* (K [bc] K 000117768, U [bc] U 0007913, US [bc] US 01108075), S [bc] S-R-8520.

Senegalia multipinnata (*Acacia multipinnata*) has previously been considered synonymous with *A. paniculata*. Ducke (1925) observed that specimens of *S. multipinnata* were collected by himself (*Ducke 11411* and *10457*), Spruce (*Spruce 494*), and Kuhlmann (*Kuhlmann 17487*) and “sub nomine *A. paniculata* distributa.” Based on our examination of the type specimen of *A. paniculata* and comparison to type materials of *A. multipinnata*, we concur that *A. paniculata* is synonymous with *A. multipinnata*, but as noted above, *A. tenuifolia* should not be considered a synonym.

The name *Acacia multipinnata* has been widely used in the taxonomic, ecological, biological, and chemical literature from the time of its publication in 1925, primarily by South American investigators: Brako and Zarucchi (1993) (as a synonym of *Acacia tenuifolia*); Clarke et al. (2001); da S. Ribeiro (1999); Da Silva (1990); Ducke (1925); Forero and Romero (2009); Jørgensen and León (1999); Lemée (1951); Madsen (1990) and Rico-Arce (2007).

Irwin (1966) segregated *Acacia paniculata* into five groups. Group A included plants with a marginal costa. We have examined two of the specimens he cited [*A. C. Smith 2388, 3445*], both from British Guiana, and found them to be *A. tenuifolia*. Irwin considered the type of *A. paniculata* to belong to this group. He placed *A. multipinnata* in synonymy with *A. paniculata* with no comment. In groups B and C, specimens had subcentral leaflet midribs. Several of his specimens of groups B and C that we have been able to examine are *A. multipinnata* (Upper River Sapary, *Krukoff 1146*; Rio Trombetas, *Ducke 11411*, the lectotype of *A. multipinnata* (Grimes 1992); Esperanca, *Ducke 1026*; Amazonas, Tres Casas, Mun. Humayta, *Krukoff 6340*; and Bolivia, near La Paz, 700-800 m, *Krukoff 10160*). The species in

Irwin's Group D and E represent an undescribed species similar to *Senegalia podadenia* (Britton and Killip) Cárdenas. Specimens of Groups D and E that we have examined are: Amapá: Rio Araguari, Pires, Rodrigues & Irvine 51192, and Rio Oiapoque, Irwin, Pires & Westra 48464. Grimes (1992) lectotypified *A. paniculata*, and located type materials for *A. tenuifolia*, which was later lectotypified (Seigler et al. 2006). Grimes considered these two species and *A. multipinnata* to be conspecific, lectotypified both *A. multipinnata* and *A. paniculata*, and placed them into synonymy under *A. tenuifolia*.

We conclude that the type materials of *Acacia paniculata*, *A. scandens*, and *A. multipinnata* represent the same species. The oldest validly published, legitimate name for this group of species is *A. paniculata* Willd. (1806). Many authors have used the names *A. paniculata* and *A. tenuifolia* and interchangeably and ambiguously. In selected cases, regardless of the name employed, it is possible from cited distributions and from morphological characters in descriptions to ascertain the probable identity of the materials examined by the authors, but in many other cases the identity of the materials studied remains an open question. *A. tenuifolia* is clearly distinct and should not be considered as a synonym of *A. multipinnata*, *A. paniculata* or *A. scandens*. Because of this confusion we have elected to use the name *A. multipinnata*, although it is not the oldest name, in order to maintain nomenclatural stability in anticipation of a proposal to conserve the name against *Acacia paniculata*.

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